Improving NRM Investment through a policy performance lens

Key words: adoption targets, NRM investment, reasonable assurance, water quality

Stuart M Whitten[1], Anthea Coggan[1], Petina Pert[1], Bradford Sherman[2].

1. CSIRO Sustainable Ecosystems
2. CSIRO Land and Water

Contact author: Anthea Coggan, CSIRO Sustainable Ecosystems, St Lucia, Qld. +61 73214 2671, anthea.coggan@csiro.au

Abstract:

Choosing a mechanism to encourage landholders to change their land management in order to deliver environmental outcomes is a complicated process. Careful instrument selection may count for little if uptake and adoption are insufficient to meet performance targets. Similarly, investors may require assurance that the proposed investment will deliver the stated goals. In order to reduce the uptake uncertainty facing policy makers we evaluate and describe several possible methods to guide and frame adoption targets. We conclude that referring to past adoption experience of a wide range of mechanisms offers the best approach to setting feasible adoption targets for future mechanisms. We call this adoption points of reference. This approach is tested by application to mechanisms focusing on delivering water quality improvements in GBR catchments. We conclude that the points of reference approach is appropriate and useful but should be supported by processes designed to incorporate the impact of heterogeneity and local knowledge and an emphasis on improving the accuracy of future data.

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1. Introduction

Delivery of public policy objectives for environmental management commonly requires private individuals to change their land management practice or land use. Government and non-government delivery agencies motivate behavioural change using mechanisms that change landholder incentives for desirable land management practices. These mechanisms may be voluntary or non-voluntary. Non-voluntary measures include prohibitions and other mandatory participation options. Voluntary mechanisms include moral suasion ("do the right thing"), provision of information, support and public recognition or financial incentives.

Delivery agencies are tasked with making decisions about where to target scarce funds in order to deliver against time delineated environmental targets. The question facing delivery agencies is which approach, or mix of approaches, is likely to deliver the desired change? Deciding which mechanisms to use to motivate landholders, and where in the landscape to target effort, is a complicated process. Delivery agencies need to weigh up questions of economic efficiency, acceptability to the community, environmental effectiveness, ease of implementation and management and a wide range of other factors in order to assess the options available.

A key element of the mechanism selection process is determining the likely adoption of mechanisms within the target community. Delivery agencies need to have confidence in their target uptake in order to achieve environmental performance objectives. Similarly, investors need confidence that their investment is appropriate and targeted and that biophysical targets will be met. Guidance on what level of adoption is achievable is also useful for ex post evaluation. The objective of this paper is to describe a method for providing guidance in setting, achieving and evaluating adoption targets.

There are a number of ways that estimates of adoption can be generated. In this paper we describe and evaluate several possible approaches before concluding that an approach broadly based on benchmarking mechanism performance in broadly comparable situations offers the best potential. Limited implementation experience, heterogeneity between different applications and lack of reported data limit the ability

to implement benchmarking style approaches and we outline a number of current shortcomings of this approach, strategies to minimise their impact, and areas for future work to improve the suggested approach.

The paper is structured as follows. In section 2 we describe the decision problem facing those tasked with delivering behaviour change as context for the points of reference approach. In section 3 we describe several approaches to estimating uptake and adoption/compliance and the conceptual development of the points of reference approach. In section 4 we present a case study application of the approach to mechanisms likely to be considered within Water Quality Improvement Plans (WQIPs) in Great Barrier Reef Catchments. The resultant points of reference along with the strengths and weaknesses of the applications are discussed in section 5. We conclude the paper in section 6 with some observations about the potential applications of the approach and what would be required to move from a 'points of reference' towards a stricter benchmarking approach.

2. Background

The decision problem

Policy makers and delivery agencies are often tasked with identifying and implementing a suitable (preferably optimal) set of mechanisms to deliver landholder management or land use change (broadly termed practice change in the remainder of this paper) and achieve specified environmental targets or objectives. As an example, consider the Australian Government's Framework for Marine and Estuarine Water Quality Protection (FMEWQP). This policy requires planners to develop Water Quality Improvement Plans (WQIPs) which identify targets, accountabilities, costs and timelines for practice change in order to achieve identified pollutant load reduction targets. Similarly, investors must be confident that their investment will deliver the stated objectives. In the case of WQIPs, Reasonable Assurance Statements (RAS) must be attached to the plan to help manage the uncertainty surrounding the achievability of practice-change targets amongst other factors. Finally, evaluation of performance requires criteria in order to determine relative performance (absolute performance should be evaluated against the stated targets).

Our objective is to describe a methodology that will provide support to the process of delivering practice change through the active consideration of likely adoption levels. At the outset we emphasise that the methodology is intended to provide guidance on how to determine and what is a *feasible* target for adoption using appropriate mechanisms rather than in setting *optimal* adoption from an economic or environmental perspective.

We note at the outset that decisions of mechanism selection should be based on more than simply that which will be adopted by landholders. Coggan and Whitten (2008) highlight that an understanding of the efficiency and effectiveness of alternative mechanisms is also essential in mechanism decision making. That is, decisions about mechanisms should be made after: an analysis of the social, institutional and biophysical drivers behind the problem; the extent and public/private distribution of costs and benefits of different management mechanisms; and spatial and institutional complexities of the solution (such as the heterogeneity of landholders and the capacity of the implementing agency). Where the process of understanding and setting targets for feasible adoption fits into broader mechanism selection processes is set out in Figure 1.

The approach described is consistent with an adaptive management philosophy and can provide practical support and guidance for implementation (such as within the Australian Government's Monitoring Evaluation Reporting and Improvement (MERI) framework).

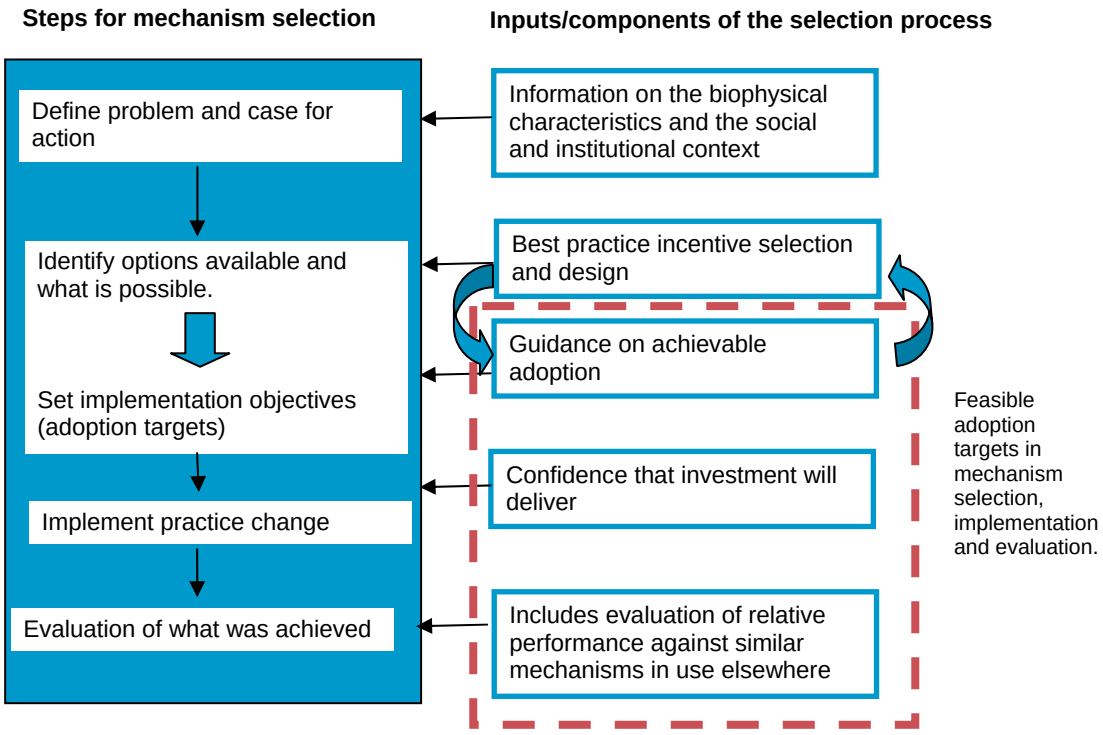

Figure 1: Adoption target support and instrument selection, implementation and evaluation

Options available to deliver practice change

There are numerous ways that government and non government agencies can engage with private land managers to deliver practice change. Mechanisms available are divided into voluntary and non-voluntary mechanisms. Voluntary approaches can be further separated into moral suasion, incentive-based, or information, advice or support based approaches each of which can be implemented through a variety of delivery approaches. A brief summary of each approach is described below (more details in Coggan and Whitten 2008).

Required actions are non-voluntary regulations or agreed performance measures. They may be underpinned by legislation or through other mechanisms such as product delivery standards. For required actions, compliance is supported by legal or financial penalties. Examples include provisions under the *Environment Protection and Biodiversity Conservation Act 1999*, native vegetation clearing laws, water pollution regulations and so on.

Voluntary instruments offer an alternative to *requiring* landholders to undertake or avoid specific actions or impacts. The motivation for landholders to 'volunteer' to engage in practice change varies between instruments. Moral suasion essentially relies on social or peer pressures for landholders to behave as a "good citizen" through creating or strengthening conformance to accepted norms of behaviour. Suasion based practice change is usually framed around messages of social responsibility and good farm management or where personal or community safety is involved. Certification is closely related to both required actions and moral suasion as it binds landholders to a specified behavioural standard often linked to market access, market premium or demonstrating an accepted standard of behaviour.

In a similar way, best management practices (BMP) describe a specified practice standard with respect to environmental or production objectives. BMPs may be developed by industry, government or a combination of the two. BMPs are usually reliant on private benefit associated with the practice change to drive uptake and adoption. BMPs are usually strongly supported by extension campaigns providing information, advice and support to landholders in order to encourage practice change.

Where adoption of practice change generates a large private financial cost, instruments that make financial payments to encourage adoption may be most appropriate. Financial payments to increase or speed practice change through cost-share arrangements, grants, auctions and tenders and other mechanisms. Incentives may also be offered through a range of less direct methods including taxes, subsidies, rate rebates and other measures. There are of course a wide range of bundled mechanisms which incorporate a range of elements to encourage practice change (for example cap and trade schemes).

The problem facing policy makers and delivery agents is: what level of practice change can be expected for a given mechanism (or mechanism mix)? Almost no practice change is likely to be fully implemented by all landholders. This is the case even for required actions that are backed by legal sanction where poorly implemented or poorly enforced mechanisms inevitably lead to low levels of adoption and therefore low effectiveness at generating practice change. On the other hand, voluntary

instruments can be highly effective. For example a local government intervention to enhance chemical container recycling (drumMuster) through information and persuasion achieved a 67% return rate (drumMuster Media Release 17/12/2007). The challenge is to develop a methodology that is robust across a range of heterogeneous settings in providing guidance as to what levels of adoption are realistic and achievable.

3. A method for describing feasible adoption of practice change

There are three broad methodologies that can be used to generate guidance on what level of practice change can be expected for a given mechanism. They are:

1. Independent expert evaluation as to the potential uptake;
2. Use of a formal modelling approach; and
3. Use of a benchmarking type approach.

Independent expert evaluation

Expert evaluation of likely adoption rates for practice change offers one potential way of providing guidance to policy makers and delivery agencies that may have little experience in either the drivers of adoption or experience in other regions. Unfortunately, experts are themselves reliant on either their experience in other settings (effectively a benchmarking approach) or an informal model (sometimes referred to as a mental model) of adoption drivers. There are also concerns about who is classified as an expert and how does one become 'qualified' or 'recognised' as holding appropriate experience to independently evaluate the likely adoption of practice change. In some cases an expert guidance approach may also reduce influence of local knowledge, experience, and 'ownership' of the proposed mechanisms from the regional bodies that will need to implement them.

What can be concluded from this brief assessment of an expert evaluation approach? First, a sound expert evaluation approach is likely to be founded on an informal modelling or benchmarking approach. The informal nature of the experts skills lead to difficulty in defining an expert and ensuring that they are able to add value to the approach. Nevertheless there is a need in any formalised evaluation approach to

ensure that local knowledge and experience can be appropriately captured – a conclusion returned to at several points in this paper.

Formal models of adoption of practice change

There is a considerable and long-standing literature on adoption in agricultural extension, and to a lesser extent in conservation management. Recent papers in the Australian context include Pannell *et.al.* (2006; 2008), Cary, Webb and Barr (2001), Barr and Cary (2000), Nelson (2004), and Lockie and Rockloff (2004). Herr, Greiner and Stoeckl (2004) discuss constraints to adoption of conservation measures and Rolfe *et.al.* (2007) and Rolfe, Wake and Donaghy (2005) for water quality. In a narrower participation context Whitten *et.al.* (2007), Morrison and Greig (2006) and Stanley, Clouston and Baker (2006) discuss drivers and constraints to participation in market based instruments and incentive programs.

The adoption and associated literature consistently identify six drivers of landholder adoption of changed management practices: cost, observability, trialability, simplicity, enterprise compatibility, and personal alignment (summarised in Table 1). Higher levels of education and financial capacity are found to increase adoption by Herr, Greiner and Stoeckle (2004) but not by other authors. Other factors that may influence adoption include:

- Environmental credibility, government policy interaction and spillovers between adopters (Pannell *et.al* 2008.);
- Flexibility and extent to which information is consistent, and level of local physical and social infrastructure (Lockie and Rockloff 2004);
- Local applicability (Cary, Webb and Barr 2001); and
- Persuasion and communication strategies (Morris, Mills and Crawford 2000);
- Labour limitations and climate variability may limit adoption in the Burdekin Dry Tropics context (Herr, Greiner and Stoeckle 2004).

Table 1. What drives landholder adoption of changed land management practices?

Driver of positive adoption of land management practice change	**What/why**
Profitability and cost implications	Direct cost implications for the farm enterprise
Observable change and impact	Observable changes in inputs (eg trash retention) or outcomes (trees planted) tend to be more easily and readily.
Options to trial changes cheaply and easily	Land managers will be more open to make changes if they can trial the change on parts of their land at low cost rather than high cost or difficult to reverse whole farm change.
Simplicity to implement and manage	Greater complexity requires greater management skills and investment of time and resources in integrating actions into the farm enterprise with a consequent reduction in adoption.
Enterprise compatibility	Practice changes that align with business structure and approach are more easily adopted.
Compatible with personal goals and peer expectations	Practice change that is compatible with landholders' goals and the expectations of peers are more readily adopted.

The adoption and broader participation literature have developed a range of formal statistical (such as Cary, Webb and Barr 2001) and less formal conceptual models to explain landholder behaviour. The adoption literature is not, however, directed towards delivering a model that would estimate likely landholder adoption in the form of targets for participation or adoption.[1] Furthermore, the adoption literature has tended to focus on the landholder side of the delivery model rather than on service delivery factors and on institutional capacity in delivery of different instruments. That is, it is widely known that the institutional capacity required to effectively implement instruments is central to their success. Yet there has been relatively little investigation of the nature of the partnerships, delivery models and so on that would be required to deliver the instruments and that would be suitable to a formal modelling approach. Without parameters describing the influence of significant uptake drivers a modelling approach is not feasible. The adoption literature does however provide a guide to the range of heterogeneities that will need to be accommodated within any proposed method.

[1] Note that a formal model would be used to estimate potential adoption rather than as an aid in evaluating whether adoption targets are deliverable which is the aim in this paper.

Three other options using formal models to estimate likely practice change were also considered: choice modelling, economic experiments, and structured expert opinion (such as a Delphi technique). These models are useful in assessing uptake for new, previously untested policy options in comparison to existing options or for design purposes. Choice models have previously been used to estimate adoption of new environmental policies by Horne (2004) and van Putten (2008). However they would be prohibitively costly and time consuming to apply across all mechanisms and estimate transfer is unlikely to outperform a benchmarking approach. Economic experiments have been used for instrument design and testing (see Rolf, Wake and Donaghy 2005, Rolfe, Windle and Kunde 2007, Connor *et.al.* 2008) but not to explicitly estimate instrument uptake. A structured expert opinion model (Delphi technique) offers the potential to combine information on likely uptake held locally and drawn from experience elsewhere. Conceptually it approximates an informal modification of the points of reference approach described below, but weakened by the fact that it would not include quantitative data on actual instrument performance.

A benchmarking approach to evaluating practice change

Benchmarking is a process in which mechanism performance is compared against comparative applications across several predetermined measures. Benchmarking has been widely practiced in the private and public sector. The Productivity Commission (2007) identified two broad benchmarking processes used to implement the relevant application, performance and standards benchmarking. Performance benchmarking is used to compare specific performance metrics across entities using a range of indicators. Standards benchmarking identifies 'best practice' standards that entities can aspire to achieve. Performance benchmarking is after the fact 'how did we perform?' while standards benchmarking involves setting specific performance objectives. Our objective is essentially a weak form of standards benchmarking whereby we wish to support *a priori* the setting achievable practice change targets but which can help inform a performance benchmarking evaluation.

Eager, Burgess and Buckingham (2003) identify three application modes: *internal* benchmarking comparing units within a single entity; *competitive* benchmarking

comparing performance between independent organisations within the same industry; and *generic* benchmarking of a particular process across industries. In an NRM context we are interested in learning from performance elsewhere and across a heterogeneous environment. Therefore we will need a mix of competitive and generic approaches if a benchmarking approach is to be useful.

Practical implementation of a benchmarking approach requires decisions about the objectives, coverage, performance indicators, data management and reporting needs of the benchmarking exercise (PC 2007). The objectives and necessary coverage (range of potential mechanisms) have been set out in Section 2. Performance indicators may be qualitative or quantitative. Quantitative indicators are preferred since they are likely to be less subjective and provide a measure of relative difference. The PC suggests appropriate performance indicators should be: acceptable and easy to interpret to stakeholders; available or cheap to collect; provide meaningful comparisons; be relevant to the objective; robust over time; and timely. Data management primarily relates to cost and ease of maintaining integrity of collection in order to maintain comparison of 'like with like'. Finally, reporting is concerned with clearly communicating information to stakeholders along with strengths and weaknesses.

'Points of reference' as the proposed method

Implementation of a benchmarking approach requires specific decisions about appropriate performance indicators, how these are to be measured, and whether they do in fact provide an appropriate comparison standard. The difficulty in applying a benchmarking approach is clearly illustrated by adoption literature which concludes that a range of drivers are important; many of which are heterogeneous across different implementation environments. Similarly our own advice with respect to mechanism design and implementation emphasises the need to select, refine and implement effective instruments that are appropriate to the specific setting. Therefore any approach to determine feasible adoption targets must retain sufficient flexibility to incorporate local peculiarities whilst remaining firmly embedded within a wider governance framework as shown in Figure 1.

The practical implication is that the mechanism should be selected, refined and implemented to suit local conditions. Any feasible adoption benchmarking approach should also be sufficiently flexible to encompass local knowledge and heterogeneity. As a result we describe the following approach as 'points of reference' rather than a 'best practice' benchmarking exercise. Points of reference are not performance standards or best practice benchmarks as such, but rather refers to what should be achievable given adequate resources (financial and implementation), and reasonable social and institutional capacity.

The 'points of reference' are intended to describe the available information about performance of different mechanisms in a range of selected contexts that offer comparability. Reference points are based on the collation of mechanism adoption performance across a range of environments that would include mechanisms already in place as well as new instruments that are in use elsewhere. There are a number of practical difficulties in identifying appropriate adoption data and presenting it in a form that would allow informed comparison across applications which are further discussed in Sections 4 and 5. We note that reference points cannot be defined using a benchmarking approach for mechanisms that are not currently in use elsewhere because no data are available that would allow potential adoption to be assessed.

The points of reference approach should be regarded as identifying a performance range that would be considered satisfactory. It is important to frame the points of reference approach to allow justification of variances that will be necessary to accommodate local knowledge and heterogeneities. For example there will be large differences in the application environment, human factors and capacities (individual/social) and regional institutions or industry capacities. Considering performance elsewhere as a reference point allows for explicit consideration of why the proposed mechanism may perform differently in a particular environment. One transparent method for documenting these considerations is to state within the proposed NRM plan why the proposed target differs from the point of reference range suggested for that mechanism.

At this point it is important to also begin to consider the limitations of the proposed approach. In particular the 'points of reference' approach is only appropriate for informing mechanism adoption, not the resultant biophysical change. Biophysical indicators of mechanism performance will need to be dealt with through other processes such as those described in Sherman and Whitten (2008).

4. Case study: Generating points of reference for mechanisms to improve water quality on Australia's Great Barrier Reef.

Background

The world heritage listed Great Barrier Reef (GBR) is situated adjacent to the Queensland and north-eastern Australian coast, consisting of an archipelagic complex of over 3000 reefs covering an area of approximately 350 000 square kilometres, the GBR is the largest reef system in the world (Haynes and Michalek-Wagner, 2000) (Figure 2).

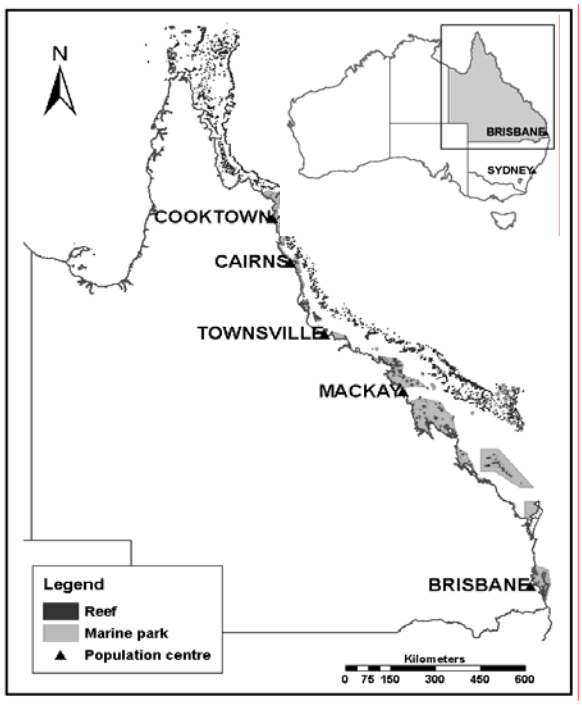

Figure 2: The Great Barrier Reef location and catchments

Water quality in the GBR lagoon has declined significantly over the last 140 years (Moss *et.al.* 1992; Neil 1997). The primary driver has been an increase in agricultural, mining and urban activities in the GBR catchments (Brodie *et.al.* 2003). For example,

sediment loads due to soil erosion have increased 3-4 fold over the last 140 years (Moss *et.al.* 1992; Neil 1997; Productivity Commission 1997). Brodie *et. al*. (2003) estimated that 15 million tonnes of suspended sediment is exported to the GBR each year. Total nutrient influx to reef waters (principally nitrogen and phosphorus) has also increased by 30% mainly since agricultural expansion in the 1970's (Brodie 1997; Pulsford 1996). Brodie *et. al*. (2003) estimate that 77,000 tonnes of Nitrogen and 11,000 tonnes of Phosphorous is discharged to the GBR from the land each year, this is 3-5 times the pre-European load.

The impacts of increased pollutant discharges into the GBR lagoon include "reduced growth, reproduction and recruitment in organisms to major shifts in the community structure and health of coral reef and seagrass ecosystems" (GBRMPA 2001 in Productivity Commission 2003).

In order to reverse the decline in water quality, the Queensland and Federal Governments made a commitment in 2003 to develop a *Reef Water Quality Protection Plan (RWQPP)*. One action under the RWQPP is for the preparation of Water Quality Improvement Plans (WQIPs). WQIPs should comprise three components:

1) **Values and impacts:** identification of the environmental values of water bodies and the water quality objectives that will protect these environmental values;
2) **Sources and status:** identification of sources and quantitative estimates of pollutant loads along with a set of targets to protect environmental values; and
3) **Actions and remedies:** identification and commitment to a set of mechanisms (termed control actions in WQIPs) and management measures to reduce pollutant loads to receiving waters and achieve water quality targets.

The actions and remedies described in WQIPs are intended to include specific adoption targets and the required investment in order to deliver on these targets. Adoption is dependent on achieving changed management on private land. WQIPs demonstrate the three roles that a points of reference approach can provide: guidance to regions as to achievable adoption rates; assurance to investors that targets can be

achieved with their investment (supported by a formal reasonable assurance statement - RAS); and an evaluation framework that should consider achievements against targets and against what is considered 'achievable'.

Building a points of reference for GBR WQIP mechanisms

Assembly of a set of points of reference for water quality mechanisms in the GBR is not straight forward and a number of steps need to be followed to ensure that the reference points are sufficiently comprehensive and accurate. Whitten and Coggan (2008) describe a wide range of mechanisms that are potentially available to WQIP proponents in delivering practice change. The range of mechanisms available were simplified into five groups of mechanisms for which adoption points of reference were described, namely: required actions or regulatory mechanisms; BMP programs; individual BMP components; grant or cost-share programs; and auctions or tenders paying for practice change.

The objective of the case study was to suggest adoption points of reference for each of the five mechanism groups. These mechanisms have been applied to many NRM issues across Australia but limited resources required a clear strategy to identify which would be most useful in guiding feasible adoption targets in GBR catchments. We adapted the '*reference business*' approach described by the Productivity Commission (2007) to identify 'reference mechanisms'. Paraphrasing the Productivity Commission approach (2007. p. xxv): *reference mechanisms would not necessarily be statistically representative of the full range of mechanisms available; nonetheless, they would account for those characteristics that are considered to be typical, or common, of mechanisms under consideration.* Reference mechanisms were chosen to reflect those that are typical or are usually under consideration in the context of analysis. Where possible we drew on applications within GBR catchments (competitive benchmarking across mechanisms within the GBR) and identified representative applications for mechanisms not in use in GBR catchments (generic benchmarking from beyond GBR catchments).

Almost all adoption targets in WQIPs are specified by industry and hence the reference mechanisms were specifically selected to incorporate the influence of

'industry social capital'. Industry social capital is intended to represent key adoption factors that are likely to differ across industries and across the region and a means of directly reflecting the impact of several important heterogeneities across catchments and industries. Indicators of industry social capital were: industry body membership; supply chain concentration; spatial dispersion; industrialisation of production technology; and a history of coordinated actions. We recognise that these indicators are likely to be correlated and incomplete but nevertheless believe them to be useful in distinguishing between adoption behaviour in industries with high, medium or low levels of social capital. A generic assessment of the level of industry social capital in the major GBR agricultural industries is shown in Appendix 1.

Reference intervention by type is summarised in Table 2. The reference mechanisms set out in Table 2 reflect the use of competitive and generic benchmarks across industries with a range of social capitals. For example, the rice and cotton industries (not active in the GBR catchments) are generic benchmarks to reflect the potential adoption of an integrated BMP package across an industry with high and medium social capital (data from the rice industry is excluded from this paper). We note that the reference mechanisms are not intended to include highly targeted interventions for special purposes – such as purchase of a specific wetland area for nutrient management. Such highly targeted approaches do not lend themselves to this approach and would be better evaluated on a case-by-case basis.

Data collected to populate the adoption matrices was collected from a mix of grey literature and self-assessed responses reported by regional stakeholders on the adoption of specified mechanisms. A summary of the reported adoption rates for the reference mechanisms for grazing, cane, horticulture and cropping (using cotton as a reference industry) industries is provided in Tables 3 to 6. Full adoption data is available in Whitten, Coggan and Pert (2008).

Table 2: Reference mechanism by type

Intervention type	Reference mechanisms used in analysis
Required action / regulatory (assessed with a mandatory best practice approach in mind)	National Livestock Identification Scheme (NLIS)
Voluntary adoption (integrated and individual best management practice adoption (1))	Cane – 'COMPASS' Rice – 'Rice Champions' Cotton - BMPs Rural Water Use Efficiency Program for Canegrowers Horticulture
Grants	Incentives for BMPs and FMS (2), devolved grants for various land management activities
Competitive tenders	For biodiversity, water quality improvements, land management

(1) Integrated BMPs are those that require all components of the BMP package to be adopted whilst individual BMPs allow reporting of uptake of individual components of the BMP

(2) Farm Management System

Table 3: Grazing industry adoption

Practice change intervention type	Reported adoption rate
NLIS* (mandatory)	>90%
Riparian management	~30%
Pasture and soil management	<30% to ~90%
Pest management	75% for flora and <10% for fauna
Chemical management	~60%
Devolved Grant – specified actions	70 participants 300 agreements signed with 200 landholders
Competitive tender – biodiversity management	15% of target audience
Competitive tender – nutrient management	Up to 50% of target population

* National Livestock Identification Scheme

Sources: Price Waterhouse Coopers (2006); Greiner, Lankester, Patterson (2007); Windle and Rolfe (2006); Roebling and Webster (2007); Fitzroy Basin Association (2007); MWNRM Draft WQIP; Rolf *et.al.* (2006)

Table 4: Horticultural industry adoption

Practice change intervention type	Reported adoption rate
Soil and trash mgmt	50 – 90% adoption
Nutrient mgmt	65 – 90% adoption
Water efficiency	60%
Drainage mgmt	95%
Chemical mgmt	100%
Pest mgmt	100%
Managerial	Not reported

Sources: Roebling and Webster 2007; MWNRM Draft WQIP

Table 5 Broad-acre cropping industries adoption (cotton)

Intervention action	Proposed point of reference
Package of BMP options	95% adoption
Pesticide application mgmt	75%
Integrated pest management	100%
Land and water management	40% to 100% depending on component

Sources: Queensland Farmers Federation *et.al.* (2005); Macarthur Agribusiness (2004)

Table 6: Cane growing industry adoption

Application	Practice change intervention type	Proposed point of reference
Industry CoP*	Package of BMPs	15% complete adoption Key action areas >40%
Irrigated (dry tropics)	Water use efficiency (voluntary)	93% involved, 63% qualified for funding
	Soil and trash mgmt	<5% to 70%
	Nutrient mgmt	30% - 80%
	Water efficiency	>80%
	Drainage mgmt	>50% - 80%
	Chemical mgmt	Med – high (~80%)
	Pest mgmt	High (85%)
	Managerial	Not reported
	Tender for water quality improving actions	22% of possible expression interest
	Devolved grant targeting specific actions	1.5%
Dryland (wet tropics)	Soil and trash mgmt	<30% - >90%
	Nutrient mgmt	~40%
	Drainage mgmt	<30% to >90%
	Chemical mgmt	<20%
	Pest mgmt	75%
	Managerial	Not reported – assume low

* Code of Practice

Sources: Roebling and Webster (2007); Mossman Agricultural Services (2006); Rolfe *et.al.* (2007); MWNRM Draft WQIP; Rolfe *et.al.* (2005); C4ES Pty Ltd 2004; Wrigley and Moore (2006); Queensland Farmers Federation (QFF) *et.al.* (2005)

Synthesised results and discussion from the case study

Tables 3-6 demonstrate that mechanism adoption varies considerably according to the specific practice change and according to the region and industry. A synthesised set of 'points of reference' for a range of mechanism types suitable for practice change in the case study region is provided in Table 7. This synthesis table can be generated because the mechanisms were reported for industries and industries can be categorised according to their industry social capital and organisation (see Appendix

1). Therefore the feasible adoption points of reference can be synthesised into mechanism type and industry social and organisational capital. The points of reference are considered to be a broad guide to attainable levels of adoption for an instrument that is selected, designed and resourced according to best practice (per Coggan and Whitten 2008).

Table 7: Suggested adoption 'points of reference' for mechanisms targeting water quality in GBR catchments

Instrument	Industry social capital and organisation		
	Low	***Medium***	***High***
Regulation / mandatory actions	<50%	50-80%	>80%
Integrated BMP package	<10%	10-50%	50%
Individual BMPs	5-30%	30-60%	60-95%
Grants (public good actions)	5-10%	10-20%	20-30%
Tenders (public good actions)	5-15%	15-30%	30-50%

The points of reference provided in Table 7 should not be regarded as definitive but rather a best estimate based on the authors' judgement across the data available for the reference industries and mechanisms in the GBR catchments. As indicated, the points of reference approach is intended to provide guidance as to what is achievable rather than specifiy performance objectives. We emphasise that regional performance is likely to be highly variable due to local design needs, and differences amongst landholder and industry characteristics – an issue returned to in the next section. Finally, as mechanisms are implemented and all stakeholders learn about design and uptake, the points of reference are bound to change. Therefore the points of reference should be updated regularly as is the case with other benchmarking approaches.

5. Issues in practical applications

In this section we discuss two critical elements underpinning the points of reference approach. Specifically we identify a number of strengths and weaknesses of the approach with respect to the impact of heterogeneity between regions and industries and whether adoption of practice change is an appropriate performance indicator. We

identify several practical steps that would support the goals we have set for the paper through the points of reference approach.

The points of reference presented are intended as performance guidance to inform the setting of practice change targets. The reference points frame what can be considered achievable targets. They do not describe the optimal target. The optimal target maximises the net benefit from investment taking into account the potential mechanisms available. It will reflect the design decisions or aspects of implementation that are unique to the region or application. The points of reference simply indicate what was achieved elsewhere. Because circumstances differ between catchments the optimal adoption target in each should necessarily differ.[2]

Essentially the heterogeneous application environment across catchments mean that a strict performance benchmarking approach as applied elsewhere (for example as part of utility pricing decisions) is unlikely to be appropriate in an NRM setting. In the GBR case study, adoption of mechanisms varies considerably according to the practice change to which it is applied and according to the region or industry in which it is applied. For example, only 15% of cane-farmers have implemented the full range of actions recommended in the industry code of practice but over 90 percent of landholders have implemented some components.

Fortunately, the WQIP process in place in the case study environment suggested a potential way out via the use of RAS. These statements offer a transparent method of documenting differences between the point of reference and the targeted adoption of each practice change. That is, they offer delivery agents the opportunity to document evidence indicating factors specific to their catchment; for example a long history of industry adoption of BMPs suggesting a relatively high target. The RAS process allows for other sources of information to be transparently included in the target setting process along with their estimated influence on relative adoption rates.

[2] The optimal rate will equal the maximum feasible rate if all landholders are required to change management in order to achieve the target. In this case the point of reference should be close to the optimum but will still not be the same due to heterogeneity between mechanism applications.

Despite the inability of benchmarking approaches to help in setting optimal adoption targets they can be designed to inform performance across differentiated environments. In the GBR case study the points of reference were differentiated according to the level of industry social capital. The adoption data indicated that adoption of similar mechanisms varied by up to 90% across industries. Not only does this discrepancy demonstrate the significance of industry social capital to mechanism effectiveness and eventual practice change but this also demonstrates the need for those who are gauging potential effectiveness in mechanism selection to have an accurate view of the social capital and industry organisation for the application region.

The variability in instrument effectiveness across industries and regions also suggests that practice-change targets are likely to shift as experience in mechanism design, implementation and management grows. Sharing the lessons from success and failure in implementation is important to facilitating rapid improvement in implementation. A points of reference approach to guiding target setting, supported by RAS type documentation of the implications of local heterogeneities provides a strong framework for strengthening informed comparison between regions.

Selecting an appropriate performance indicator is critical to any benchmarking approach. In this case an unexpected complication is the difference between adoption and conformance. Adoption is not necessarily a suitable basis for assessing the likely effectiveness of specific control actions such as BMPs. Conformance (reflecting systemic integration of the practice change across all relevant aspects of a farm, business or institution) may differ from stated adoption for a variety of reasons. For example, stated adoption may be partial, either spatially or in detail of application. BMPs may be misunderstood, or there may be outright inconsistencies between reported adoption and conformance.

The ‘points of reference’ approach is not currently suited to assessing conformance as a separate target from reported adoption. The level of conformance to the practice change is however the relevant measure for evaluating the likely water quality improvement. Roebeling and Webster (2007) indicate that expert opinion (as opposed

to verified data) about adoption suggests that conformance may differ by up to 65% of the target population from the reported adoption rate (regional NRM group or growers organisation). Clearly such large and systemic differences between adoption and conformance complicate the use of any approach in understanding the level of practice change that is actually achieved. Benchmarking conformance, even using the relatively low data requirement of a 'points of reference' approach, would require field audit data on the extent of conformance that is not currently available.

The difference between reported adoption and conformance highlights the need for effective and comprehensive monitoring, evaluation, reporting and implementation framework (MERI) to support adoption. Inclusion of a well designed MERI plan within the WQIP or other practice change mechanism selection process would generate data on conformance that could be used to benchmark future investment under subsequent investment strategies. Of course there are also risks attached to potentially intrusive monitoring and conformance programs that will need to be considered by delivery agencies in the design and implementation of MERI plans.

A final observation from the case study is that a large proportion of the target population do not adopt the desired practice change. There is little point in setting low adoption targets unless efforts are also devoted to designing and implementing effective mechanisms to support practice change.

6. Conclusions

The points of reference approach meets the objectives set out in this paper of guiding policy makers and delivery agencies, assuring investors and framing evaluation. Specifically, the reference points provide guidance to help frame mechanism adoption targets, give investors confidence that these are achievable, and potentially to provide context for evaluation of relative performance. Any application of the approach requires attention to detail to ensure that heterogeneity in application environments is sufficiently accounted for and that the performance indicators are accurate.

The GBR case study application demonstrates that the technique can be applied in a complex real world setting. The technique is able to incorporate sufficient flexibility to incorporate some of the drivers of adoption that are likely to vary across industries and regions by differentiating between adoption experiences under different levels of industry social capital. The case study also demonstrates some of the complexities that are always present when implementing policy mechanisms in a heterogeneous environment: most notably the challenge of providing guidance and confidence without restricting the flexibility that is necessary for effective implementation at the regional scale. It is important that processes incorporate elements that encourage the inclusion of local knowledge into the process in a transparent way. The RAS process within the GBR case study provides a clear basis for substantiation of practice change targets that differ from the suggested point of reference. It is recommended that a comparable process is used to support future applications.

The accuracy of data is critical to implementation of any objective comparative approach such as benchmarking. The case study illustrated some of the complexities in the application of a points of reference approach to adoption versus conformance to practice change by landholders. There is a clear need for informed data collection which avoids differences in reported adoption and which would allow a more accurate assessment of the degree of practice change and estimated impact on water quality. More effective data collection over a period of time would also help researchers to understand the time trajectory of adoption and whether there is dis-adoption. Improved data sets would move the points of reference approach towards a performance benchmarking approach through tighter conformance to a competitive benchmarking approach. Fair and comprehensive evaluation of the performance mechanisms supporting practice change will encourage delivery agents to actively seek and apply best practice design and implementation, enhance investor confidence in delivery agents, and encourage innovation under competitive pressures.

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Appendix 1: Assessment of industry social capital

Industry	Industry body membership	Supply chain concentration	Spatial dispersion	Industrialisation of production methods	History of coordinated actions	Overall industry social capital
Cane	~80% in Canegrowers	High – mills are virtual monopsony with single desk export sales	Highly concentrated in small areas	Medium, higher in irrigated areas	Moderate – some areas have high uptake, others lower.	**High** (Medium in some regions)
Grazing (extensive)	~70% in Agforce Qld (may be overestimate)	Low in production chain (high following abattoirs)	Widespread with low population density	Low – little or no use of fertilisers and actively improved pastures.	Low – NLIS implementation only obvious example	**Low** (May be moderate in some regions)
Grazing (intensive)	~70% in Agforce Qld (expect lower in intensive due to increased part-time)	Low and likely to be further complicated by many small operators	Widespread but higher population densities	Low but increased use of fertilisers and improved pastures.	Low – NLIS implementation only obvious example	**Low** (May be moderate in some regions)
Cropping (cotton)	67% paid voluntary grower levy to Cotton Australia in 06/07	High – single gin per region	Low – small number of co-located growers	High – irrigated, high management crop	High – focus on BMP uptake over several years.	**High**
Horticulture	Disparate industry groups but likely to be high overall	Moderate – high where single processing plant.	Pockets of high concentration with some larger areas.	Very high to medium depending on product.	Variable – – some good examples in small areas.	**Medium** (varies by region and industry)

Low: Two or more of poor membership of industry body, disparate supply chain, high spatial dispersion, little industry wide coordinated activities or low industrialisation of production methods.

Medium: One or more of strong industry membership, intensive or industrial production systems, or highly concentrated industry, concentrated supply chain or a history of industry sponsored coordinated activities.

High: Two or more of strong industry membership, intensive or industrial production systems, or highly concentrated industry, concentrated supply chain or a history of industry sponsored coordinated activities.